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AN ANALYSIS OF THE NORTH AMERICAN SPECIES OF THE GENUS *CALLOPHRYS*

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INTRODUCTION

EXAMINATION OF CERTAIN SPECIMENS of Callophrys from montane habitats in California and Oregon indicate that these specimens belong to a cluster distinct from others so far described, and not fitting well with any known description of North American Callophrys. The purpose of this paper is to discuss certain characteristics of North American *Callophrys,* and to provide a name for the previously unrecognized series of populations. This name is needed for two forthcoming faunistic papers.

TAXONOMIC HISTORY OF *CALLOPHRYS*

Linnaeus (1758) described *P* (*apilio*) *P* (*lebeji*) *rubi* as follows: "Rubi. 154. P. P. alis dentato-subcaudatis; supra fuscis, subtus viridibus."

Billberg (1820) proposes the genus *Callophrys* with three groups, based on three tails, two tails and one tail. In the one-tailed group only *rubi* is listed.

Scudder (1875), selected *rubi* as the type of *Callophrys* as follows: "1820, Billb., Enum. Ins. 80: Vulcanus, rubi, and a Ms. species. Rubi may be taken as the type."

Until recently *Callophrys* has been limited to those few hairstreaks that matched *rubi* in every respect. The palaearctic names, besides *rubi* itself, include *borealis* Krul., *polaris* Möschl., *fervida* Stgr., *sibirica* Rühl and *suaveola* Stgr., omitting abberations that have been named. All of these have been considered both as full species and as subspecies or variants of *rubi.* Of these only *rubi,* as type of genus, will be mentioned further.

Ziegler (1960), combined the groups placed under *Mitoura* Scud., *Incisalia* Scud., *Sandia* Clench & Ehrlich, and *Callophrys* Billb., under the oldest name, *Callophrys,* as subgenera. This move had been presented in abbreviated form previously by Ehrlich and Clench (1960) in the paper describing *Sandia mcfarlandi.* Clench, in Ehrlich and Ehrlich (1961) used a similar arrangement but several genera are

proposed for groups of hairstreaks outside the scope of this paper, which is concerned only with the members of the presently considered subgenus *Callophrys* as limited by Scudder's designation of *rubi* as the type.

THE AMERICAN SPECIES OF THE SUBGENUS *CALLOPHRYS*

All species of the subgenus *Callophrys* resemble one another very closely, and can be separated with any degree of assurance only by considerable effort. There always remain specimens the position of which is a matter of opinion in the light of present knowledge. There are two revisions of the group. Barnes and McDunnough (1923), grouped the species in a manner superior to previous treatments and described three subspecies. Clench (1944) revised the genus (as it was then considered) proposing one subspecies.

At present at least ten names are involved in the North American *Callophrys* (s. str.), and these have been regarded at one time or another as representing six distinct species. Characters that have been used to distinguish the various species have been color markings and wing shape. The male terminalia are exceedingly similar in all the named entities. This is not to say that differences may not exist, but so far they are not apparent. The present author has also dissected the female genitalia of the North American species and the European *rubi.* These studies have not resulted in any conclusions in time for the present paper.

An attempt has been made to examine all parts of the external surface of the body. Small differences may be detected in the palpi, antennae, facial hairs or tuft, and in wing shape, stigma and color markings. The results of these comparisons are given in Table 1.

It seems pertinent to include here a discussion of the problem of the identity of *dumetorum* Bdv. Boisduval (1852) writes (free translation from the original French) that "this Thecla resembles our *rubi* in every respect and is most likely only a local variety of that species." Close examination of *rubi* in comparison to specimens usually considered to represent *dumetorum* Bdv. shows a number of minor differences, but without doubt the two are closely related. Certain problems arise in deciding what would properly be considered as *dumetorum* Bdv. Clench (1955, op. cit, p. 220) gives a description of what he at that time regarded as *dumetorum.* The description suggests that he is describing the insect for which a new name will be proposed in this paper.

The Boisduval description could fit any of several named segregates. The figure by Oberthur (1913) shows a gray insect with overscaling of a cast of green not usual in the subgenus, and with a rather more complete macular band than one expects in insects that pass for *dumetorum* in collections. W. D. Field, of the Smithsonian In-

situtation, has kindly given me a detailed comparison of the insect figured by Oberthur, and which is usually regarded as the type of *dumetorum*. Whether or not this specimen is actually the one on which Boisduval based his description is not certain; this does not seem to be stated explicitly. Field informs me that Oberthur's figure is a faithful representation of the supposed type specimen. This specimen is a gray female with the fringes white or pale-tipped with a conspicuous macular band and no antennae.

This female specimen, by virtue of being illustrated by Oberthur, may need to be regarded as a lectotype, the illustration being one method of designation, as was suggested by Field (in litt). A possibility exists that it may indeed be the specimen described by Boisduval, but this point can not be settled in light of present knowledge.

Neither Boisduval's description nor Oberthur's illustration seem to fit exactly any presently known population of *Callophrys*. Either *dumetorum* was described from unusual specimen, or from some since unlocated population, or (most likely) neither the illustration nor the description are completely recognizable in relation to some well-known population. Of the specimens compared with the type, there seem to be fewer discrepancies with the lowland population most commonly considered to be *dumetorum,* except that the type is a gray female while the females of the lowland population tend to be brown or fulvous. However, gray females are not entirely unknown. The macular band is more than usually well-developed in the "type," but the band is variable in all species, and specimens from the foothills of the Sierra Nevada are known with complete macular band. The choice here made is to continue to use the name *dumetorum* for the cismontane lowland population of California, while retaining the option of changing this opinion should future findings make such a change desirable.

The exact locality where Lorquin collected his original specimen, subsequently named *dumetorum* by Boisduval, is partially in doubt, as is frequently the case with the Lorquin-Boisduval specimens. Species described in 1852 were from Lorquin's earlier collecting. In some of the descriptions there are phrases such as "Mountains of the Juba," suggesting that the specimens were taken near the mining operations along the Yuba River. A reading of Lorquin's adventures in California brings the same conclusion; that he was in the Sierran mining region prior to 1852. This is presumptive evidence, but certainly better than no inference at all. Specimens of *Callophrys* from the Sierra Nevada foothill localities relate to the populations from coastal and southern California rather than to those of the high Sierra Nevada. Here again the evidence favors use of the name *dumetorum* for the low elevation insects.

Should incontrovertible evidence subsequently be found, that this

Character	*dumetorum* auct.	*apama*	*viridis*
wing fringes	fuscous basally; pale tipped; not clear white	dark fuscous basally; pale tipped, dark scales mixed.	fuscous; the tips mixed pale and fuscous scales
fore wing apex	obtuse-angled	obtuse-angled	obtuse-angled
forewing, outer margin	oval in female; straighter in male and indented at Cu_2	oval in female; male slightly produced between Cu_1 and M_3	curved to M_1 or M_2; then nearly straight; tornus slightly incurved
hindwing, outer margin	crenate in spaces Cu_1, Cu_2 and 2nd A. (indentations shallow)	small crenation in space Cu_2; a deeper one in space 2nd A	hind wing appearing more than usually quadrate; crenations very slight
color of forewing costa below	fulvous, more marked in female	pale brown to dull fulvous; concolorous with other brown areas of wing	rich fulvous in both sexes
forewing below	invaded by gray or fulvous from anal margin to at least vein M_1	anal margin gray; disc invaded by rich fulvous at least to vein M_1	gray confined to anal cells only
vein-tips of hind wing below	vein tips and marginal line usually rusty-brown scaled	narrow but complete marginal line, outbrown, mesially black, inwardly white; vein tips dark	brown scales at vein-tips absent or nearly so
Macular band (lower surfaces of wings)	usually reduced to 3 spots; seldom complete; macules inwardly brown, then white	hindwing: complete, spots in Cu_1 & Cu_2 displaced out. Tricolored, 4-5 spots forewing	complete on both wings (though narrow) to reduced; mesial brown scaling reduced
shade of green below	grass green to golden green	rather dull green, brightened by admixture of fulvous scales	deep, frequently bluish, green.
scaling of labial palpi	black above, mixed black & white below; may have few green scales near base	hairs and scaling smooth; black above and below; white scales laterally	grizzled black and white throughout; third segment very pointed; scaling sparse, green scales basally
facial hairs (facial tuft)	erect or slightly proclinate; thicker laterally; black with green scales at bases	hairs markedly proclinate, thicker laterally; basal green scaling	erect or slightly proclinate; thicker laterally; black or gray; green scales at base
forewing stigma of male	small, ovate, usually gray and lighter than ground color	ovate to oval; gray, slightly lighter than ground	small, ovate, distinctly paler than ground color, or concolorous
antennal annuli (white rings)	usually 15 (seldom 16)	usually 15 (seldom 16)	14-17 (av. 16 in 34 specimens); antennae pale above (unique)
general facies as seen from above	male uniform fuscous with pale-tipped fringes; female brown with fulvous discs and pale-tipped fringes	male uniform dark fuscous; female same with very large fulvous discal areas	gray insect with nearly concolorous fringes; females usually gray (very seldom partly brown on disc)

TABLE 1

CHARACTER COMPARISON OF NORTH AMERICAN *CALLOPHRYS* (S.STR.)

affinis	sheridani	comstocki	lemberti n. sp.
basally fuscous; pale-tipped to white tipped	bases darker than wing; tips mixed white & fuscous	bases darker than wing; tips white, contrasting	basal scales mixed brown and gray; tips snow white (usually); occ. fuscous scales
approx. right-angled, tip rounded	acute, the forewing trigonate	rectangular; effect of short sharp tip	pointed, nearly as in sheridanii
curved to M_2, thence nearly straight to tornus	slight curve to M_1 or M_2, then straight to tornus or slightly concave	quite evenly curved, the curvature slight	curved to M_3 slightly indented between Cu_1 & Cu_2
quadrate, nearly rounded; crenations slight or obsolete	rounded; crenations scarcely visible	longest between M_3 & Cu_1; crenations evident but minute	rounded, crenations slight, between Cu_2 & 2nd A one is evident
gray to clay-colored, not contrasting	blackish; darker than rest of wing	dark in most males; concolorous to pale fulvous in females	narrowly brown or fulvous; contrasting
gray from anal margin to Cu_2; general wing surface green	dark gray to vein Cu_2	gray area extensive, to M_2 (one female) on to across wing to costa (one male)	gray confined to anal cells; even here some green overscaling
slight brown at each vein-tip; terminal line not differentiated	spots at vein tips not evident; terminal line black	dark vein tips not evident; terminal line black, narrowly white inwardly	usually slight dark points at vein tips on both pairs of wings; approaches checkering
obsolete, or one spot in cell Cu_2	complete; straight; white; edged within and without by black	band complete but of separate spots; bowed out at cell Cu_2; macules white, black inwardly.	complete band to obsolete of discrete white spots black inwardly, narrow; obscure on forewing
uniform pale yellow-green	deep dark green scales mixed with dark gray scales about equally	deep dark green, the veins slightly contrasting dark	green scaling thin, uniform, bright pale green, the undercolor showing through
palpi slender and thin scaled; mixed black and gray all over	dark above; scaling below dense; mixed black and light gray (effect dark)	palpi slender, pointed; scaling sparse; dark above, mixed black & white below	palpi slightly darker above but mixed white and black scales throughout; third joint darker
facial hairs light gray, sparse, procumbent	dark, dense, slightly proclinate; underscaling prismatic, not green	tuft dense, coarse, black, proclinate; subscaling covered or obscure	hairs sparse, fine dark, sub-erect; green sub-scaling prominent
dark to black, sharply contrasting	stigma usually nearly concolorous with wing	small, slightly pale to concolorous and scarcely discernible	stigma small, subtriangular, concolorous to pale; seldom dark
17	av. 17 (16-18)	15-16	16 (17 on one specimen)
fulvous to bright rufous with dark terminal line & pale fringes	dark gray with black terminal line and white fringes; sexes alike in color	gray insect with dark terminal line and white fringes; sexes concolorous	mouse gray smooth-scaled insect with white fringes; females concolorous or dull brown (fuscous)

TABLE 1 (continued)

rubi	Incisalia augustinus	Mitoura siva	Sandia mcfarlandi
basally dark; tips with a few pale hairs	mixed brown & gray basally; tips sordid gray; dark at vein-tips (checkered)	forewings fuscous; hindwings pale-tipped	basally brown and fuscous mixed; tips white
tip quadrate, bluntly pointed	tip rectangular or nearly acute	rather acute	obtuse
rounded to M_3; thence nearly straight to tornus male indented at Cu_2	rather evenly curved but slightly flatter before tornus	quite evenly rounded slightly flattened before tornus	rounded
two well-marked crenations at cells Cu_2 and 2nd A.	at least a suggestion of a crenation between each pair of veins	tailed at Cu_1 & Cu_2; not crenate	tornal crenation evident, slight
broadly fulvous in female; narrowly so or gray in male	concolorous with wing	slightly fulvous, not greatly contrasting	lemon yellow to apricot
gray confined to anal cells	no contrast	fulvous invasion from anal margin almost to costa	yellow to apricot shade across entire wing
vein-tips brown; terminal line warm brown in female, less so in male	terminal line dark brown to black; veins not contrasting	complex pattern of black, white and rufous overscaling	terminal line black, invading vein tips
of small separated narrow white spots; nearly complete to obsolete	complete band of small round dark spots; dark basal shade	complete, irregular from inward out of bands of brown, black & white	narrow, complete, white flanked each side with black
grass green-suggests dumetorum	ground color pale vinaceous brown	smooth pale green scaling where other patterns are not evident	basically a luminous yellow-green
mostly dark with white scales on sides; green scales usually evident	mixed black & white scales; darker above	black above and at tips; basally, white overscaling	dark above and at tips; white scaling below and laterally; rather long
sparse, dark, mostly lateral; median green sub-scaling prominent	dense dark rich brown, procumbent; sub-scaling covered	very sparse, procumbent; iridescent underscaling very visible	hairs fine, short & erect; mixed black & white; subscaling dark
elongate-oval; androconia rather rough	very long oval, androconia small; black to pale	elongate-oval; dark to pale	elongate, about 3 times as long as wide
16	18	17, narrow and clear-cut	15-16; antennae very short, each segment short
gray with nearly concolorous fringes (male); dark brown with concolorous fringes (female)	dark brown with checkered fringes (male); female lighter richer brown	dark brown insect with fulvous on discs and two dark dots near hind wing tornus; female more fulvous	brown insect with fulvous discs & white fringes

TABLE 1 (continued)

position is untenable and that the population herinafter described as unrecognized is actually true *dumetorum,* the populations now conconsidered as *dumetorum* and its variants must then become known as *perplexa* B. & McD., as the oldest available name definitely assigned to this coastal insect.

The notations in Table 1 are of necessity short. In some cases amplification is given in the species discussions. The characters used in Table 1 vary in the samples from the different populations, but the degrees of quality given are averages. In all cases the samples were adequate (twenty-five or more specimens) to large (fifty to one hundred specimens) except for *affinis* and *comstocki.* Of the latter, only four specimens were available for close study, and some fifteen specimens were examined in all.

For comparison, one species each of the subgenera *Incisalia, Mitoura* and *Sandia* (which contains a single species) are included and comparison will show that most of the characters used are specific rather than generic or subgeneric. The subgenus *Xamia* was excluded from lack of material, and the subgenus *Cyanophrys* because it enters our fauna only along the extreme southern border.

Clench (in Ehrlich & Ehrlich) defines *Callophrys* (s. lat.) and its subgenera primarily on genitalic characters. The subgenus *Callophrys* includes species with valvae not capped; the cornuti of the aedeagus slender, not spatulate; the scent-pad (stigma) well-developed, and the labial palpi about 1½ times as long as the vertical eye diameter. (This last character is shared with the other subgenera except for *sandia,* the palpi of which are about twice as long as the vertical diameter of the eye). The scales of the stigma are entire and with rounded ends and the hind wing is not tailed.

In addition may be mentioned the tornal "tab" of the hind wings, shared with *Incisalia;* the reduction of the hind wing marginal crenulations, restricted usually to the last three cells (much more extensive in *Incisalia*); the usually even green overscaling of the inferior surfaces, typical of the subgenus, and the complete lack of the thecla spot. The markings below are restricted to the submarginal band (macular band as frequently stated), which is often reduced or even absent, even in a single species. There is no other evident ornamentation.

In the following analyses of the species, only the original citation is given.

Callophrys rubi (L.)

Syst. Nat. 10th Ed. 1:483, No. 154:1758

Palaearctic. Range Europe and Asia. By some considered the only valid palaearctic species. Closely resembles *dumetorum* as considered here, but the green darker, the female less broadly fulvous, the wing

fringes less contrasting, the stigma more elongate, and the under surface of the forewing not greatly invaded by gray or brown. In all specimens examined, the terminal line of the wings is much more evident.

Callophrys dumetorum (Bdv.)

Ann. Ent. Soc. France (2) 10:291:1852

A fuscous (male) or usually broadly fulvous (female) insect with pale-tipped but not white fringes; hind wing with three crenations, terminal line not strongly contrasting. Green below warm grading to yellowish green in southern specimens, nearly distinctive. Forewing deeply invaded by gray (male) or tan (some females) at least to vein M_1 and frequently (subspecies *perplexa*) to forewing costa. Veins of secondaries below dark tipped, the border usually clouded with brown scales. Whether or not this species is correctly identified as *dumetorum,* it is one of the distinctive entities of the subgenus. The invasion of the forewing by gray or brown seems diagnostic in its range. The subspecies *perplexa* B. & McD. (1923) is more yellowish-green below, the band reduced or obsolete (usually) and with the forewing invasion frequently extending to the costa. However, reduction of the macular band occurs in all populations of *dumetorum* (as well as in nearly all other populations of *Callophrys*) and this character must be used with caution. The macules of the band are bicolored, brown inwardly, outwardly white.

Callophrys apama (Edw.)

Papilio 2:137:1882

A very dark fuscous (male) or fuscous with broad fulvous discs (female) insect with fringes slightly pale-tipped, not notably contrasting. Green below rather dull but mixed with fulvous scales, giving a superficial appearance of being lighter than is really the case. Macular band (nominate *apama*) complete, the macules in spaces Cu_1 and Cu_2 displaced outwardly, the macules of the band tricolored, inwardly brown, mesially black and distally white. Facial tuft peculiar, sparse, rather light in color and the hairs markedly proclinate in all of the specimens examined. The name *homoperplexa* B. & McD. (op. cit., p. 68) was given to specimens such as those from Colorado, in which the macular band tends to become obsolete. The shade of green and the other characters remain similar.

Callophrys viridis (Edw.)

Though usually considered a synonym of *dumetorum, viridis* appears to be as distinct as most of the species, and was ressurected from synonomy by Clench (1944). It is a dark gray insect in both sexes when fresh (old specimens fade to a lighter gray), the fringes pale-

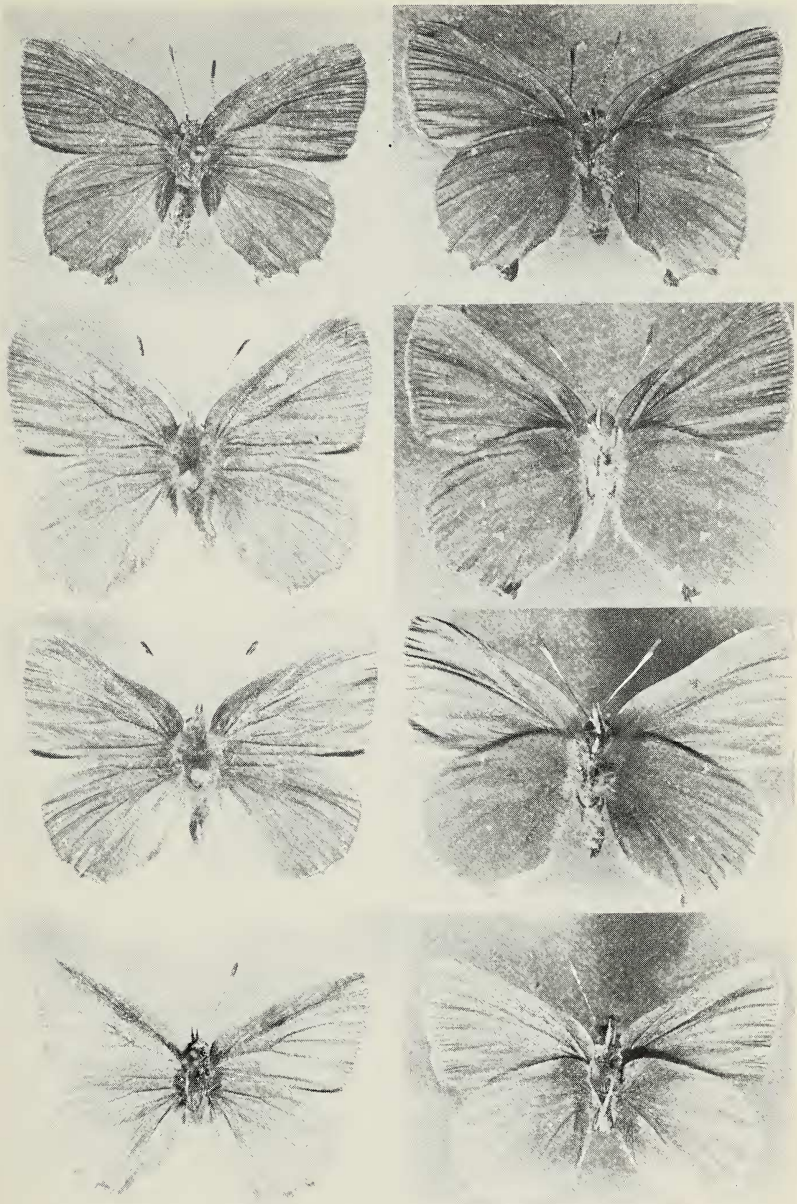

Fig. 1. *Callophrys*. Upper side to left; lower side to right. *Callophrys rubi* L. Near Hannover, Germany, 12:IV.52. G. Hesselbarth.

Callophrys dumetorum Bdv. El Portal, Mariposa Co., Calif. 16.IV.61, ca. 1200', J. W. Tilden.

Callophrys viridis Edw. Twin Peaks, San Francisco, Calif. 16.III.57, J. W. Tilden.

Callophrys affinis Edw. Dry Canyon, Salt Lake County, Utah 14.VII.49, J. C. Downey.

Photography by Jean Norton.

tipped and usually contrasting, particularly on the hind wings. Occasional females in a long series are brown, very seldom fulvous, and normally females cannot be separated from males on color alone. The outlines of the wings are more quadrate than in other members of the subgenus; the crenations of the hind wings are discernible but small. The forewing below has the gray limited to the anal margin, not invading the disc. The green below is dark and frequently bluish, quite distinctive. The antennae are pale to whitish above, seemingly an unique character. The range in California is rather narrowly limited to the coast, from Santa Cruz County northward. Its range beyond California needs to be clarified. It flies very early in the year, late February to early April, and seldom leaves the vicinity of *Eriogonum* (usually *E. latifolium* Sm.) except to visit nearby flowers. It is partial to flowers of Umbelliferae. Its flight is low and easily overlooked. In spite of reports to the contrary, *viridis* seems to be the only species of the subgenus found in the immediate environs of San Francisco, and is also common in similar habitats in Marin County.

Callophrys affinis (Edw.)
Proc. Acad. Nat. Sci. Phila., 223:1862

A fulvous to bright rufous insect, with dark terminal line and usually dark contrasting stigma, the fringes pale-tipped to white, usually very contrasting. Below, uniformly pale yellow-green (nominate *affinis*), the macular band obsolete or represented by one or two minute macules only. This describes nominate material from Utah. North and west, specimens associated with this species are less fulvous above, more bluish-green below. *Washingtonia* Clench (1944) is based upon such specimens from Brewster, Washington.

Callophrys sheridanii (Edw.)
Field and Forest 3:48:1877

Whether this name is to be attributed to Edwards or to Carpenter may be a matter of opinion. A rather short badly written article with several misspellings and typographical errors, by Carpenter, states that Edwards is describing the species. It reads: "Thecla *sheridonii* (sic), new species, is named in honor of Lieut. Gen. P. H. Sheridan, U. S. Army, by W. H. Edwards, Coalberg, West Virginia, at the request of W. L. Carpenter, U. S. Army. Size and form . . . " Inasmuch as it is expressly stated that Edwards is writing the description and that it is at the request of Carpenter, the position is taken here that Edwards is the author of the name. However, the alternate opinion has also been expressed. In any case the present spelling is an emendation of an evident lapsus calami.

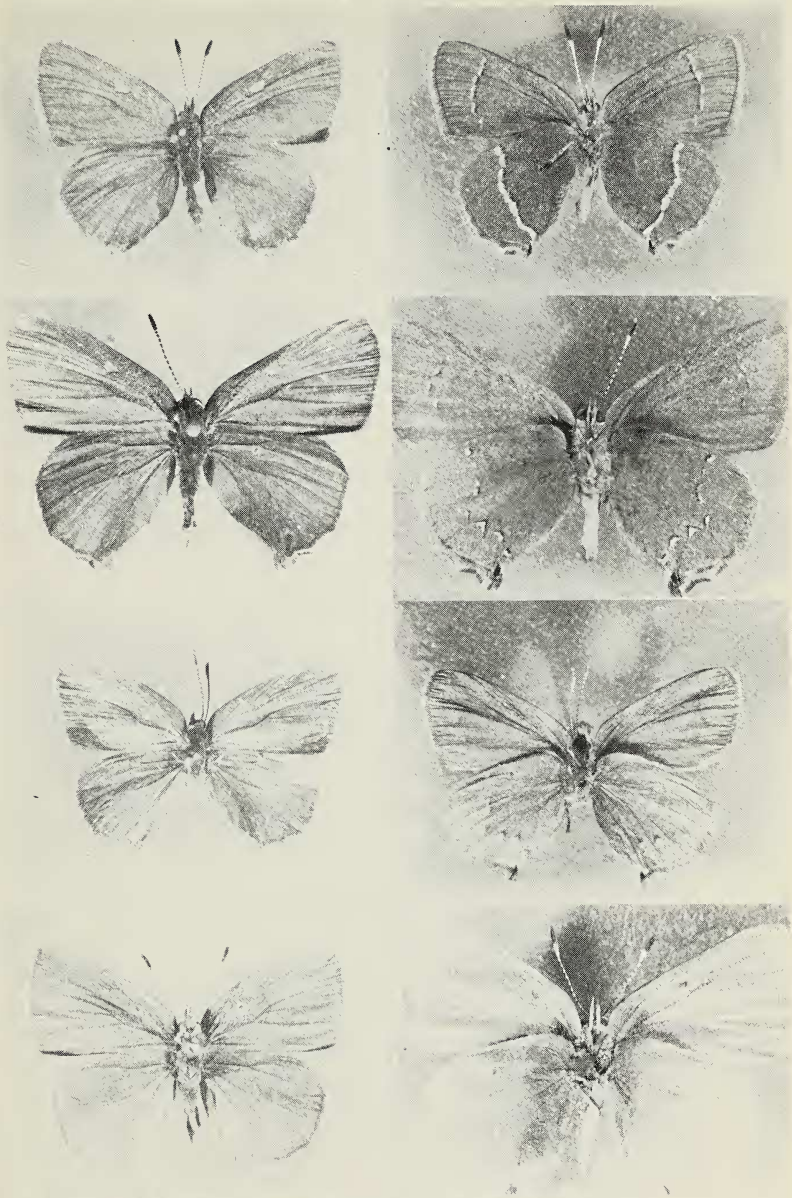

Fig. 2. *Callophrys.* Upper side to left; lower side to right.

Callophrys sheridanii Edw. Flagstaff Mt., Boulder Co., Colo. 17.IV.52, Don Eff.

Callophrys apama Edw. Strayhorse, Greenlee County, Ariz., 7.VII.58, 7800 ft., J. W. Tilden.

Callophrys comstocki Henne Providence Mts., San Bernardino Co., Calif. 2.IV. 50, Ray Hulbirt.

Callophrys lemberti Tilden, n. sp. West above Tioga Pass, Yosemite National Park, Calif. 8.VII.58 ca. 10500 ft., O. Shields.

Photography by Jean Norton

Sheridanii is the most divergent species in an otherwise closely related group. It is dark gray above in both sexes, with a black terminal line and white-tipped contrasting fringes. The stigma of the male is small, usually concolorous and not immediately evident. Below, the green is very dark and mixed almost evenly with black scales. The forewing is more acute than in the other species and the secondaries appear smaller and more evenly rounded. The facial tuft is unusually dense, erect and black, and most specimens show eighteen annuli in the antennae. The macular band is only slightly arcuate and is not usually broken into discrete macules. It is white mesially, faced on both edges with black. The name *neoperplexa* B. & McD. (Contrib. 5:671:-1923) was applied to specimens from Utah in which the macular band tends to become reduced or obsolete. The western range of *neoperplexa* remains to be established, but it appears to extend into eastern Oregon and eastern Washington.

Callophrys comstocki Henne

Bull. So. Calif. Acad. Sci. 39:71:1940

This species was described from the desert region of San Bernardino County, Calif. (Providence Mountains) and specimens are relatively scarce in collections. The precarious climate results in good populations of adults only in favorable years. *Comstocki* has been considered either a distinct species or a subspecies of *dumetorum*. Examination of the short series available to me for study, while not conclusive, indicates that *comstocki* is separable from other named segregates of the subgenus by characters at least equal to those defining most of the species. It is a gray insect in both sexes, the terminal line dark, the fringes white tipped and contrasting at least on the secondaries. The green below is dark, the veins slightly darker than the background color. The stigma is small, scarcely discernible and the facial tuft is dense, coarse, black and proclinate, almost concealing the underscaling. The vein tips are not dark on the hind wing below, but the terminal line there is black, nearly complete and inwardly bordered narrowly with white. The forewing is deeply invaded by gray, a character (almost the only one) it shares with *dumetorum*. The macular band is complete but of discrete macules, inwardly black, outwardly white, and the spot in cell Cu_2 is displaced outwardly.

Callophrys lemberti Tilden, n. sp.

A mouse-gray smoothly scaled species with pale or concolorous stigma and contrasting white-tipped fringes. Sexes similar, or females dull brown. Green of lower surfaces pale, the scaling thin, the ground color showing through. Macular band complete to obsolete, unusually narrow, of discrete macules.

Holotype male: Costa of forewing 13 mm.; costa upcurved to basal

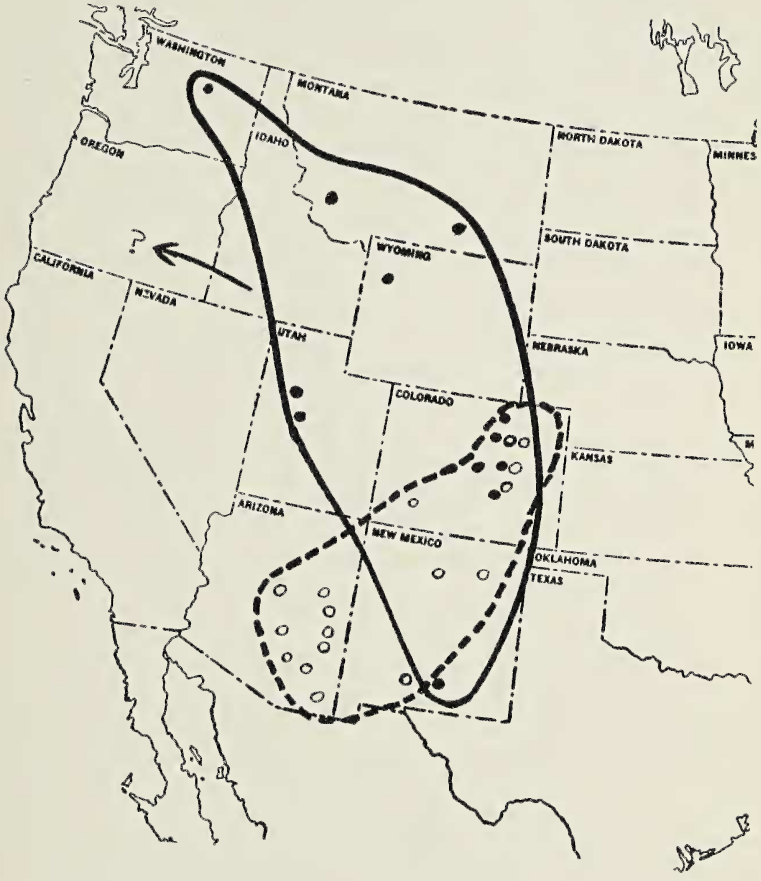

Fig. 3. Map showing distribution of *Callophrys apama* (°) and *C. sheridanii* (•).

third of cell, then straight to end of $R_2 + 3$, curved down thence to apex; outer margin of forewing curved to M_3, thence nearly straight to *2nd* A except for a slight indentation between Cu_1 and Cu_2; tornus diagonal, anal margin nearly straight. Hindwing: Rs=*2nd* A; $M_1 = Cu_1$, these the longest veins in this wing; two slight marginal crenations between Cu_1 and Cu_2 and between Cu_2 and *2nd* A; white annuli of antennae 16 as seen from lateral view; palpi dark above, grizzled black and white on sides and below, rather more blunt than usual in the subgenus but of no significance, since other specimens of the type series have palpi more pointed than in the holotype; facial area with gray, slightly proclinate hairs, the vestiture more dense laterally and with few irridescent green subscales showing through; body dark above, pale below; the legs annulated dark gray and white.

Upper wing surfaces gray (nearly mouse gray), the veins very slightly darker but not greatly contrasting; stigma nearly concolorous with wing; fringes of forewing concolorous at base, white at tips; fringes of hind wing concolorous gray mixed with golden brown scales at base, snow-white and contrasting at tips; tornal table downturned and dark.

Lower wing surfaces with smooth, pale, slightly yellowish green (nearly apple green) overscaling, which is thin, the gray ground color showing through between the individual scales, costa of forewing pale brown, moderately constrasting; anal area of forewing gray from margin to Cu_2, the gray not invading the disc; forewing with a slight suggestion of a macular band with macules in cells M_3, Cu_1 and Cu_2; fringes as on upper surface.

Secondaries with green overscaling over entire surfaces; macular band nearly complete but narrow, the macules narrowly black inwardly, outwardly and more widely (about ⅔) white; the macule in cell *3rd* A is a short dash; that in cell *2nd* A directed diagonally toward wing base; that in cell Cu_2 also diagonal but displaced towards wing margin by about one-half its own length; macule in cell Cu_1 lacking on right wing, indicated by four or five white scales on left wing; that in cell M_3 very faint, dull white and narrow; that in cell M_2 faintly indicated by a lack of green overscaling only; no macule in cell M_1; macule in cell Rs small but distinct; fringes nearly as on upper surface except for clusters of dark scales at vein tips, suggesting incomplete checkering; the tornal tab centrally black, narrowly faced on each side with white hairs; hairs of vannal margin gray at end of macular band, thence nearly white to base.

Allotype female: Forewing costa 13.5; wing shape and proportions essentially as in holotype male; white annuli of antennae 16 (an incomplete 17th on base of club); facial area with hairs sparse (as is frequent in female *Callophrys*); Body and legs as in holotype male.

Upper surfaces dull gray-brown, darker and very slightly more

Fig. 4. Map showing distribution of *Callophrys viridis* (1), *lemberti* (2), and *comstocki* (3).

brownish than holotype male. Costa above with warm brown scales, some of which invade the wing nearly to vein Sc; fringes of forewings dark gray at base, white at tips, of hind wings brownish at base except for dark gray patches at vein tips, the fringe tips white; tab down-turned and dark, the fringes in the tornal area invaded by gray, the tips less contrasting.

Green overscaling of lower surfaces as in the male; forewing costa warm brown (nearly cinnamon); macular band indicated by two indistinct macules, in cells M_3 and Cu_1; fringes light gray at base, with darkenings at vein tips; fringe tips white; gray anal margin free of green overscaling not quite to Cu_2; macular band of hind wings very narrow, the spots small and white with the inward black scaling scarcely more than suggested, the band slightly bowed out but the macules not noticeably displaced; macules in cells M_2 and M_3 obsolete; fringes pale gray, distinctly dark at vein ends, appearing checkered; fringe tips white; a faint subterminal row of paler green scales before the fringes; tab and vannal margin as in holotype male.

Type material: Holotype male, West above Tioga Pass, Yosemite National Park, Calif., 9:VII.62, leg. Oakley Shields; allotype female, same locality, 10.VII.58, leg. Oakley Shields; seven designated paratypes as follows: 1 male 8.VII.58 (Shields); 2 males, + 1 ♀ 19.VII.52 (Tilden); 1 male 25.VI.61,, + 1 ♀ (Dirks); 1 male, 25.VI.62 (Dirks): All paratypes from same locality. Type locality: West above Tioga Pass, about 1 mile, where the Gaylor Lakes Trail reaches its highest point before dropping down to Gaylor Basin, thence southerly along the ridge to rock oucrops, about two to three hundred yards.

Type material distributed as follows: Holotype male and allotype female in the collections of the California Academy of Sciences; one male paratype in the collection of Oakley Shields, La Mesa, Calif., one male paratype in the collection of the Los Angeles County Museum; one female paratype in the collection of the Carnegie Museum, Pittsburgh, Penn.; one male paratype in the collections of the National Museum, Washington, D. C. The males are retained by the author because they have been dissected to examine the genitalia. Certain other specimens from the type locality are at hand but are in too poor condition to form paratypes.

Variation in the type series: In flown specimens the green appears very slightly darker; the macular band is never more complete or conspicuous than in the types. In three paratypes the macules of the band are smaller and in one specimen the band is very faint. One male paratype has the stigma very pale; in one other the stigma is slightly darker than the ground color.

Recognition characters for *Callophrys lemberti,* n. sp. are the smooth gray upper surfaces, nearly similar in both sexes; the very contrasting white-tipped fringes, particularly on the hind wings; the very narrow

Fig. 5. Map showing distribution of *Callophrys affinis*.

but frequently nearly complete macular band; the sub-checkered fringes of the hind wings below. It may be separated at a glance from *dumetorum* by the smooth gray upper surfaces and white fringes, and by the restriction of the gray of the lower surfaces of the hind wing to the anal margin. From *viridis* it may be separated by smaller size, more trigonate forewing and the pale green scaling below. From *comstocki* is may be known by the lack of contrast between ground color and the wing veins, especially on the lower surfaces of the hind wings, and by the more regular and narrower macular band and the contrasting brown coloration of the forewing costa. It bears no confusing resemblance to the remaining species. Specimens of *lemberti,* n. sp., collected long ago, tend to fade, the females particularly showing a sordid gray-brown above. The tendency of *Callophrys* specimens to fade is general.

Specimens from other localities than the type locality referred to *lemberti,* n. sp., are: 1 male, 1 female, west slope Mt. Dana, Yosemite National Park (Tilden); 1 male, 1 female, Warren Creek, Mono County, Calif. (Shields); 1 female, Mammoth Crest, Mono Co., Calif. (J. Powell); 2 males 1 female, Chipmunk Flat, Tuolumne County, Calif. (J. Powell); 2 males 1 female, the knobs just north of Sonora Pass, Stanislaus County, Calif. (Shields); 1 male 6 females, Ebbetts Pass, Alpine County, Calif. (J. Powell); 1 male 1 female, Leviathan Peak, Alpine County, Calif. (J. Powell); 1 male, Echo Lakes Area, Eldorado County, Calif. (Dirks); another male from Echo Lakes, without collector label; 1 female, Mt. Tallac, Eldorado County, Calif. (F. X. Williams, 1909); 1 male, Tamarack Lake, Eldorado County, Calif. (no collector label); 1 male, Crater Lake National Park, Klamath County, Oregon (D. Huntzinger); 1 male, west slope Mt. Thielson, Klamath County, Oregon (Shields), 26 specimens in all extending from the Central Sierra Nevada to nearly central Oregon. In addition there are several apparently conspecific specimens too worn to use for reference.

The species is named in honor of an early collector in the Tuolumne Meadows and Tioga Pass sections of what is now Yosemite National Park.

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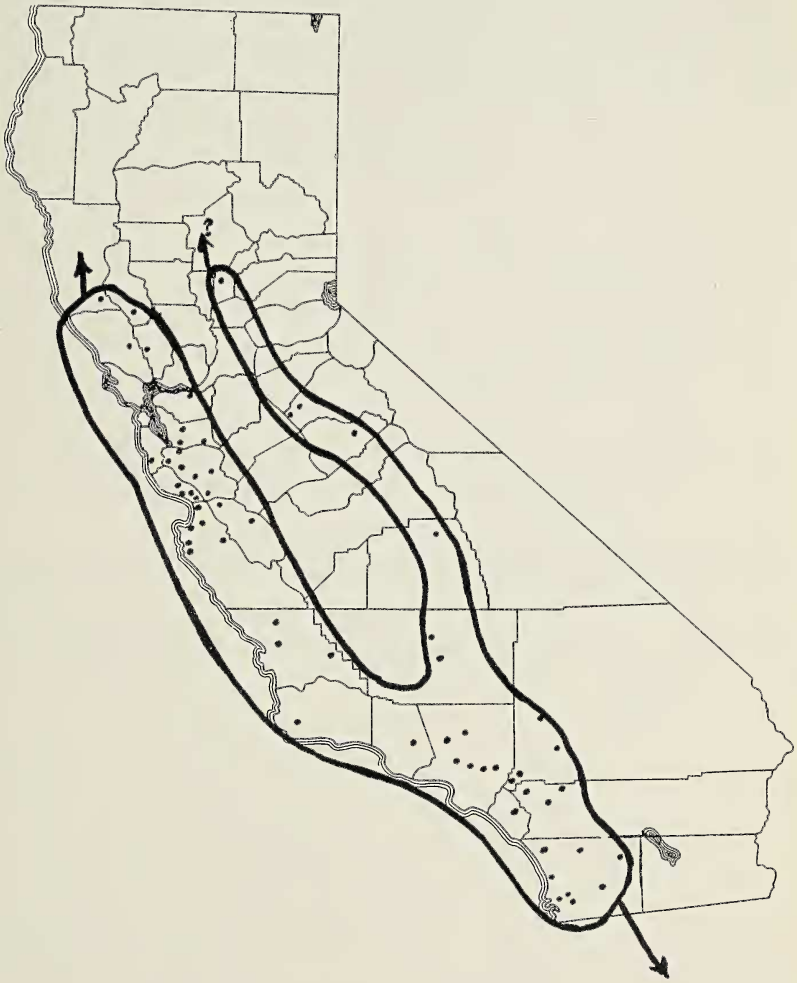

Fig. 6. Map showing distribution of *Callophrys dumetorum*.

SUMMARY

The species of *Callophrys* Billberg, s. str., are compared by use of certain minor characters mostly previously unused. An unrecognized species, *C. lemberti,* n. sp., is described. Specimens other than those of the type series are referred to this new name and the range as now known is given, being from the central Sierra Nevada of California to Mt. Thielson, Oregon.

REFERENCES

BARNES, W., & J. McDUNNOUGH 1923. *Contrib. Nat. Hist. Lepid. North America.* 5:64.

BILLBERG, C. J. 1820. *Enumeratio insectorum in Museo Billberg, p.* 80.

BOISDUVAL, JEAN A. 1852. *Lepidopteres de California. Ann. Soc. Ent. France,* (2) 10:291.

CLENCH, H. 1944. *Notes on lycaenid butterflies.* a. The genus *Callophrys* in North America. *Bull. Mus. Comp.* Uoo. 94:217-229.

CLENCH, H., in EHRLICH, P. R., & ANNE H. EHRLICH. 1961. *How to know the Butterflies,* 200-211.

EHRLICH, P. R. & H. CLENCH. 1960. A new subgenus and species of *Callophrys* (s. l.) from the southwestern United States. *Ent. News* 71:137-141.

EDWARDS, W. H. 1862. *Proc. Acad. Nat. Sci.,* Philadelphia, p. 223.

————. (in CARPENTER, W. L.) 1877. *Field & Forest,* 3:48.

————. 1882. *Papilio* 2:137.

HENNE, C. 1940. *Bull. So. Calif. Acad. Sci.,* 39:71.

LINNEAEUS, C. 1758. *Systema Naturae,* 10*th* Ed., 1.483.

OBERTHUR, C. 1913. *Etudes Lep. Comp.,* Fasc. IX (Partie lre) Pl. CCXXXVI, fig 1926.

SCUDDER, S. 1875. *Proc. Am. Acad. Arts & Sci., Boston,* 10:132, no. 202.

ZIEGLER, J. B. 1960. Preliminary redefinition of North American Hairstreak genera. *J. Lep. Soc.,* 14:19-23.